

Claims

We claim:

1. A tensioner comprising:
 - an electric actuator;
 - 5 a force imparting member engaged with a lever arm;
 - a pulley journaled to the lever arm, the pulley engagable with a belt;
 - the force imparting member engaged with the electric actuator whereby the force imparting member is axially
 - 10 moveable by the electric actuator;
 - a load sensor coaxially engaged with the force imparting member, the load sensor detecting and transmitting a load signal to a controller; and
 - the controller using the load signal to control a
 - 15 force imparting member position.
2. The tensioner as in claim 1, wherein:
 - the force imparting member comprises a lead screw;
 - the lead screw rotatably engaged with a threaded
 - 20 collar.
3. The tensioner as in claim 1, wherein the electric actuator comprises an electric motor.
- 25 4. The tensioner as in claim 1, wherein the force imparting member is engaged with the electric actuator through a gear transmission.
5. The tensioner as in claim 1, wherein:
 - 30 the load sensor further comprises a bore, the load sensor coaxially engaged with the force imparting member through the bore.

6. The tensioner as in claim 1, wherein the lever arm is pivotally engaged with a mounting surface.

7. A system for adjusting a tension of an endless belt
5 comprising:

a tensioner having a toroid load sensor and a pulley journaled to a lever arm, the pulley in contact with an endless belt for applying a belt load to the endless belt;

10 the toroid load sensor detecting a belt load and transmitting a belt load signal to a controller; and

the controller using the belt load signal to select a pulley position for a belt load.

15 8. The system as in claim 7, wherein the tensioner further comprises:

an axially moveable member moveable by an electric actuator;

20 the lever arm engaged with the axially moveable member; and

the toroid load sensor coaxially engaged with the axially moveable member.

9. The system as in claim 8, wherein:

25 the electric actuator further comprises an electric motor, the electric motor engaged with the axially moveable member through a gear reduction transmission.

10. A method of controlling a belt load comprising the
30 steps of:

engaging a belt with a pulley, the pulley journaled to a pivoting lever arm;

positioning the lever arm for a belt load;

using a toroid load cell to detect a belt load;

selecting a belt load value corresponding to a desired belt load;

comparing the belt load to the belt load value;

determining a new lever arm position based upon said
5 belt load value; and

moving the lever arm to the new lever arm position to set the belt load to the belt load value.

11. The method as in claim 10 comprising:

10 detecting an engine parameter; and

selecting a belt load value with respect to the engine parameter.

12. A method of tensioning a belt comprising the steps
15 of:

engaging a tensioner having a toroid load sensor with a belt;

adjusting the tensioner position to impart a belt load to the belt;

20 detecting the belt load with the toroid load sensor;

comparing the detected belt load with a desired belt load; and

adjusting the tensioner position with a controller until the detected belt load is substantially equal to
25 the desired belt load.

13. The method as in claim 12 comprising the steps of:

selecting the desired belt load with respect to an engine operating parameter.

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14. The method as in claim 13 comprising the step of:

selecting the desired belt load with respect to an engine operating speed.

15. The method as in claim 13 comprising the step of:
detecting an engine operating temperature;
selecting the desired belt load with respect to the
engine operating temperature.
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16. The method as in claim 12 comprising the step of
selecting the desired belt load from a look up table.
17. The method as in claim 15 comprising the step of
10 storing an engine temperature history in a controller
memory.
18. The method as in claim 12 comprising the steps of:
using a reference tooth on the belt;
15 detecting each passage of the reference tooth with a
sensor to determine cumulative belt cycles;
storing the cumulative belt cycles in a memory for
analysis of a belt fatigue condition; and
informing a user.
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19. A method of computing a belt modulus comprising the
steps of:
engaging a tensioner having a load sensor with a
belt;
25 adjusting the tensioner to a first position (P1) to
impart a first belt load (L1) to the belt;
detecting the first belt load (L1) with the load
sensor;
adjusting the tensioner to a second position (P2) to
30 impart a second belt load (L2) to the belt;
detecting the second belt load (L2) with the load
sensor; and
computing a belt modulus using (L1), (L2), (P1),
(P2).

20. The method as in claim 19 further comprising the steps of:
- storing the calculated belt modulus values in a controller memory;
 - comparing the calculated belt modulus values to identify a belt modulus trend; and
 - informing a user.
21. The method as in claim 19 comprising the steps of:
- using a first limit switch to detect the first position (P1); and
 - using a second limit switch to detect the second position (P2).
22. The method as in claim 19 comprising the steps of:
- adjusting the tensioner by driving the tensioner with a fixed duty cycle for a first duration to position (P1); and
 - adjusting the tensioner by driving the tensioner with a fixed duty cycle for a second duration to position (P2).
23. A method of computing a belt modulus comprising the steps of:
- engaging a tensioner having a load sensor with a belt;
 - adjusting the tensioner to impart a first belt load (L1);
 - detecting the first belt position (P1) with the limit switch;
 - adjusting the tensioner to impart a second belt load (L2);

detecting the second belt position (P2) with the limit switch; and

computing a belt modulus using (L1), (L2), (P1), (P2).

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24. The method as in claim 23 further comprising the steps of:

storing the calculated belt modulus values in a controller memory;

10 comparing the calculated belt modulus values to identify a belt modulus trend; and
informing a user.

25. A tensioner comprising:

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an electric actuator;

a lead screw engaged with a lever arm;

a pulley engagable with a belt, the pulley journaled to the lever arm;

the lead screw engaged with the electric actuator

20 whereby the lead screw is moveable by the electric actuator;

a load sensor coaxially engaged with the lead screw, the load sensor transmitting a load signal to a controller; and

25 the controller using the load signal to control a lead screw position.

26. The tensioner as in claim 25, wherein the electric actuator comprises an electric motor.

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27. The tensioner as in claim 25, wherein the lead screw is engaged with the electric actuator by a gear transmission.

28. The tensioner as in claim 25, wherein:

the load sensor comprises a toroid load cell having
a bore;

the toroid load cell coaxially engaged with the lead
5 screw through the bore.

29. The tensioner as in claim 25, wherein the lever arm
is pivotally engaged with a mounting surface.

10 30. The tensioner as in claim 25, wherein the lead screw
is rotatably engaged with a collar.